

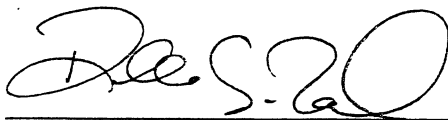
QUARTERLY PROGRESS REPORT

DRD 875MA-003

April 2002 – June 2002

**Marshall Space Flight Center
Safety and Mission Assurance Mission Services Contract
NAS8-00179**

Approved:

A handwritten signature in black ink, appearing to read 'R. S. Reed', is written over a horizontal line.

**Randall S. Reed, Program Manager
MSFC S&MA Mission Services**

July 5, 2002

**Hernandez Engineering, Inc.
Building 4471
Marshall Space Flight Center, AL 35812**

TABLE OF CONTENTS

Section	Title	Page
	Table of Contents	2
1.0	Introduction	3
2.0	General Management.....	3
2.1	Data Requirements	3
2.2	Personnel Status	3
3.0	Business Management	3
4.0	Performance of Work and Use of Facilities and Equipment	3
4.1	Safety	3
4.1.1	Industrial Safety (IS).....	3
4.1.2	System Safety	5
4.2	Reliability.....	6
4.2.1	Reliability & Maintainability (R&M) Engineering.....	6
4.2.2	Problem Assessment Center (PAC) Operations.....	7
4.2.3	ALERT Program	8
4.3	Quality	8
4.4	Information Management (IM)	11
4.5	Human Exploration and Development of Space (HEDS) Assurance.....	13
4.5.1	International Space Station (ISS) Independent Assurance	13
4.5.2	Space Shuttle Independent Assurance	13
4.6	Project Assurance	13
4.7	Risk Management and Risk Assessment	14
4.7.1	Risk Management.....	14
4.7.2	Risk Assessment.....	15
4.7.3	Space Shuttle Probabilistic Risk Assessment (PRA)	16
4.7.4	Reliability Prediction & Risk Assessment	16
5.0	Cost Reduction Items.....	18
	Attachment 1	
	Attachment 2	

1.0 INTRODUCTION

Hernandez Engineering, Inc. (HEI) successfully performed all required activities and tasks, as described in this report, in fulfillment of their Safety and Mission Assurance (S&MA) Mission Services Contract (NAS8-00179) with NASA's Marshall Space Flight Center (MSFC). This report covers a three-month period of the contract's third quarter of the first option year: April 2002 through June 2002.

2.0 GENERAL MANAGEMENT

2.1 Data Requirements

The third quarter of the first option year of the S&MA Mission Services contract was successfully completed on June 23, 2002. All Data Requirements (DR) Documents were submitted on or ahead of schedule throughout the quarter. They included DRD 875CD-001 On-Site Employee Location Listing; DRD 875MA-002 Financial Management Reports; DRD 875MA-003 Progress Reports (Monthly/Quarterly); DRD 875MA-006 Operations Plan, Problem Assessment Center (PAC); DRD 875MA-007 Quarterly Open Problems List; DRD 875MA-008 Monthly Newly Opened/Closed Problem Summary; DRD 875SA-002 Mishap and Safety Statistics Reports; and Quarterly Safety Performance Evaluation.

2.2 Personnel Status

(b) (4)

3.0 BUSINESS MANAGEMENT

We have experienced no financial or business management problems during this period. We attribute this to close attention to details, effective use of established controls designed to efficiently respond to program changes---both anticipated and unexpected---and the continuing support of our corporate financial group's dedicated efforts at controlling overhead expenses.

The contract continues to have a total cost underrun at the end of this period---see the June 2002 Monthly Financial Report, DRD 875MA-002, for specifics. Attachment 2, Man-Hours Expended, of this report contains a description, by major task, of the total man-hours expended this period.

(b) (4)

4.0 PERFORMANCE OF WORK AND USE OF FACILITIES AND EQUIPMENT

4.1 Safety

4.1.1 Industrial Safety (IS)

The Industrial Safety (IS) group performed 89 OSHA compliance facility inspections and provided all required reports in a timely manner. Also, IS performed 466 construction site compliance inspections to monitor adherence to OSHA and MSFC safety standards. All facility

safety violations were documented in the HAZTRAK databases in order to assure MSFC's compliance with OSHA, NASA, and other consensus code requirements.

Among other activities, IS: (1) updated seven facility fire evacuation plans; (2) participated in one pre-construction conference; (3) performed seven final safety inspections of facilities under renovation or construction; (4) reviewed 89 sets of facility design drawings for compliance with OSHA and consensus codes; and, (5) performed 11 fire drills.

In support of the MSFC initiative to become VPP Star Certified, IS continued to provide (b) (4) to assist the VPP Communications and Implementation Teams, and general communication of safety awareness to all MSFC employees. (b) (4) and other IS team members included: (1) assisting QS01, the SHE/VPP Implementation, Organization Coordination, Steering, and Training Committees; (2) developed and published multiple PowerPoint presentations; (3) prepared five safety bulletins for use on the SHE web site; (4) developed and processed multiple safety topic messages for the SHE web site, SSWP, and MSFC Employee TV; (5) drafted, published, reproduced, and distributed the weekly SHE Highlights; (6) initiated the year 2001 Annual SHE Program Self-Evaluation for the VPP Implementation Team and reviewed the draft report prepared by SAIC; (7) developed numerous PowerPoint presentations; e.g., a training unit for the planned new SHE members and sub-committees, SHE goals for sub-committees, and the new SHE proposed organization chart; (8) assisted with the new SHE Committee Charter; and, (9) assisted to prepare for and participated in the QS50 sponsored stroll down "Safety Lane" in the 4200 complex.

As a major significant effort, IS continued to provide extensive support to the planning and design review activities associated with the planned new Propulsion Research Laboratory (PRL). Support included: (1) participation in the weekly meetings; (2) performing numerous safety assessments and facility inspections of current hazardous operations scheduled to be relocated in the PRL; and, (3) detail preparation for and participated in the early April 100% design review at the Jacobs/Sverdrup Orlando, Florida office.

IS initiated, completed, or followed up on more than a dozen facility safety assessments (SA). Examples included: (1) completed the Operational Hazard Analysis (OHA) for the dual crane lifting and handling operations for the Combined Environments Test Fixture at Buildings 4650 and 4554 for which IS served as the critical lift monitor; (2) completed the SA for the Antimatter Antiproton Trap (HIPAT); (3) assisted the responsible organization/user finalize acceptable closure rationale for hazards identified in the IS prepared SA for the 18' x 20' Autoclave in building 4707 and participated as the Industrial Safety Department safety representative during the Safety Review Team; (4) completed the SA for the Safe Affordable Fission Engine (SAFE) 9' Vacuum Chamber; (5) continuing to perform a SA for the Micro Light Gas Gun in building 4612; (6) followed up on the SA for the Gas Dynamic Mirror (GDM) Fusion Experiments; and, (7) performed an OHA for a personal lifting platform using the 12T crane to inspect the 360T crane in the test area.

As a significant strength, IS continued to provide (b) (4) to the MSFC Test areas. Examples of support included: (1) pre-test, post-test, and safety monitor duties for the 24-inch Motor; (2) reviewed and approved numerous hazardous operations test

procedures; (3) monitored the test firing of the 11-inch Hybrid Motor; and, (4) provided daily support to test engineers and S&MA personnel on technical issues.

IS continued to support the implementation of the NASA lifting standard, NSS/GO 1740.9 by providing day-to-day advice and assistance to S&MA customers. In May, IS prepared and presented an overview briefing to QS50 addressing the changes and impact to MSFC, and provided recommendations to prepare for full implementation of the new NASA-STD-8719.9, Standard for Lifting Devices and Equipment. This new lifting standard replaced NSS/GO 1740.9. As value added, IS prepared an information paper providing suggested options for administering proficiency exams for lifting equipment and device operators at MSFC; e.g., riggers and mobile cranes. In addition to performing several OHA's, IS: (1) served as the S&MA safety monitor for critical lift operation for the test fixture at the Materials Environment Complex (METCO) Facility; (2) assisted the Facilities Engineering Department review and develop a hazardous operations plan, job hazard analysis and facilities work request for the installation of the powered platform lifting device, purchased by MSFC, to repair/replace window calking on buildings 4200, 4201 and 4202; (3) continued to develop an improved and detailed PowerPoint presentation course materials for Safety and Quality monitors of critical lifts for approval by the Safety Environmental and Health (SEH) Training Committee; and, (4) administered hands-on proficiency examinations to two overhead-crane/hoist operators in support of the MSFC Personnel Certification Program.

4.1.2 System Safety

System Safety (SS) participated in the following technical meetings: Presented status report on temperature strip issue for g-LIMIT, supported the Flight Readiness Review (FRR) for Mechanics of Granular Material (MGM)/STS-107, supported the Integrated Payload (IPL) Critical Design Review (CDR), supported the Booster Separation Motor (BSM) propellant contamination issue, supported the Space Launch Initiative (SLI) review of the System Requirement Document (SRD) which was three major TIMs, supported the wrong material fastener issue on the ET, supported a pre-Phase II TIM with the Safety Review Panel for Node 3, supported a COBRA Pre-board on SLI, supported technical discussion for establishing new inspection and repair criteria for EPDM Covers, supported technical reviews and discussion of the newly generated Integrated Hazard Electrical Fire/Arc Tracking for the ET, and supported the Flight UF-4 SAPH Ground TIM and Hardware Acceptance meeting.

Payload Safety completed/initiated 8 Safety Data Packages. These were: Node 2 Phase III Flight Safety Data Package (SDP), Biotechnology Carriers (BIC) reflight SDP, Environmental Control and Life Support Systems (ECLSS) hazards for Node 3, Phase II Ground Safety Data Package for DELTA-L, Altus Cumulus Electrification Study (ACES) Operating Support Hazard Analysis (OSHA), Microgravity Science Glovebox (MSG) Belgian Taxi Flight Integration (MSG-BTF/I) Flight Safety Data Package, Glovebox Integrated Microgravity Isolation Technology (G-LIMIT) Phase III Flight Standard Analysis Reports, and MSG- 11A/I Flight Safety Data Package.

System Safety attended the American Institute of Aeronautics and Astronautics/International Astronautical Federation Reusable Launch Vehicles Symposium. In addition, system safety

attended the High Pressure System Safety training course, and participated in the Fundamentals of System Safety Training class.

System Safety reviewed and provided comments to: SSME integrated hazard analysis (IHA), the annual update of hazard reports for the SRB, the Thermal Enclosure System (TES) Verification Plan, the System Safety Review Panel (SSRP) presentation charts, the alternate SRB coating ECP, and Revision A of P&W HPFTP/AT hazard analysis.

System Safety provided technical support for the following: The Multi-Purpose Logistics Module (MPLM) was supported on-console at JSC for the STS-111/Flight UF-2; the ET, SRB, RSRM, and SSME Shuttle Elements were supported at the Huntsville Operations Center (HOSC) for the STS-110 launch; the Gravity Probe B (GP-B) final technical meeting for the Missile System Prelaunch Package (MSPSP) was supported at Vandenberg Air Force Base; a trip to Belgium and the Netherlands was conducted to support hazards determinations of the BTF and its integrations into MSG; and a Safety Figure of Merit (FOM) was developed for 2nd generation Reusable Launch Vehicle (2 GRLV) which will be used to assess various architectures.

4.2 Reliability

4.2.1 Reliability & Maintainability (R&M) Engineering

In support of the Advanced Projects Assurance Department, R&M continued providing R&M discipline support to the 2nd Generation Reusable Launch Vehicle program, including review of program documentation to ensure that R&M requirements are correctly specified. R&M is also actively involved with the High Power Electric Propulsion program. R&M represented MSFC S&MA at the NASA Ultra-Reliability Workshop and presented a status of the reliability effort for the Space Launch Initiative.

In support of the Shuttle Assurance Department, significant R&M activities included participation in the flight readiness review and launch support activities for STS-110, STS-111, and STS-107 as well as active participation in various anomaly resolution teams. R&M served as the S&MA lead participant in the Power Bus Isolation Supply Anomaly Resolution Team investigating the acceptance test failure of an SRB Integrated Electronics Assembly and was actively involved in the failure analysis process and development and evaluation of corrective action/recurrence control options. R&M also actively participated in the RSRM field joint pin protrusion issue, and presented the issue as part of the STS-111 Prelaunch Assessment Review. Additionally, R&M continues to support ongoing effort related to Shuttle Upgrades, including active participation in the ET friction stir weld process development, as well as in the qualification process for the SRB Command Receiver Decoder and Altitude Switch Assembly.

In support of the Cargo Assurance Department, R&M has been extensively updating the ISS Node 2 FMEA/CIL and submitting it to ISS R&M on a subsystem-by-subsystem basis. As part of this update, the Node 2 analysis has been compared to the baselined USL analysis to ensure consistency, previously unanalyzed hardware has been included, and all worksheets are being reviewed and concurred with by appropriate Node 2 subsystem engineers. During this period,

FMEA/CIL worksheets for the Command and Data Handling system, Passive Thermal Control System, and Structures and Mechanisms were finalized and resubmitted to ISS R&M. R&M also participated in the Node 3 Architecture Review TIM and Regenerative ECLSS Integrated Rack CDR, and is continuing development of the ECLSS R&M deliverables. R&M participated in the Preliminary Design Review (PDR) for the GLAST Burst Monitor (GBM), and is developing the FMEA for the GBM. In the process of performing the GBM FMEA, it was recognized that the design of the GBM power control electronics includes a single failure point that could result in loss of GBM mission capability, which violates a GBM requirement. R&M coordinated this issue with GBM project personnel so that options for resolution could be identified and implemented in a timely manner, resulting in cost savings to the GBM program. R&M also participated in the MSRR Integrated Payload Rack CDR, and is in the process of updating the R&M deliverables in response to CDR RIDs.

4.2.2 Problem Assessment Center (PAC) Operations

HEI's PAC personnel processed and coordinated disposition of problem reports, supported launch milestones, coordinated the MSFC Problem Assessment System, and operated the Corrective Action System (CAS). The PAC received and entered 16 new problem reports (PRs) into MSFC's Problem Reporting and Corrective Action (PRACA) System, coordinated MSFC interim closure of 38 PRs, received 26 prime contractor closure recommendations, supported MSFC full closure of 19 PRs, coordinated non-problem closure of 4 problems, and performed 245 individual PR database updates and reviews. We conducted 8 SSME problem review boards, dispositioning all 35 problem reports presented. The PAC generated or updated trends for all SSME, RSRM, and SRB problems submitted as newly opened or for closure. We also generated and distributed monthly bubble trend risk charts for 1 and 5-year problem data, 12-month new problems moving averages for data over the last year, and age charts for currently active problems.

The PAC supported 7 pre-launch milestones for STS-111, STS-107, and STS-112 in addition to Shuttle Project PFAs and coverage of Level A countdowns and launches of STS-110 and STS-111. This included providing open problems listing and counts, real-time meeting support, and/or issue analysis on open MSFC PRACA critical problems. In support for the launch attempts, we extracted and provided copies of KSC PRACA problems as they were entered at KSC for MSFC S&MA review during Level A countdown. We also used a PAC-generated spreadsheet of all countdown problems from STS-72 (1996) through current and the Shuttle PRACA webPCASS data system to provide additional data regarding problems occurring and being discussed during Level A. During Level A coverage of STS-111, we contacted webPCASS coordinators to inform them that their system was not functioning and prompted them to correct the problem. We also participated in the Shuttle Assurance countdown lessons learned discussions.

In problem system coordination, the PAC conducted 2 SRB Problem Assessment System (PAS) status reviews for the SRB Chief Engineer and other SRB Project and S&MA personnel; provided regular interface, implementation advice, and status tracking regarding reportable problems; screened MSFC PRACA access requests; drafted updates to the Standard DRD on

problem reporting; and reviewed and coordinated/facilitated MSFC review of proposed revisions to the USA-SRB BP Q-341 problem reporting procedure.

The PAC provided various problem data in support of NASA and MSFC analyses. Regular activities included providing daily KSC PRACA shuttle problem summaries, daily MSFC PRACA open-against-next-mission summaries, daily KSC Resident Office reports, monthly HEDS new shuttle problem charts, and monthly newly opened/closed problem summaries. Special activities included circulating MSFC In-Flight Anomaly listings for STS-110; preparing and presenting an explanation of the MSFC PRACA Demonstrated Reliability Bubble Trend Charts to representatives on NASA HQ and other Centers at the 5th Annual Assurance Technology Conference at Glenn Research Center; researching and providing summary listings of the SSME preburner diffuser crack problem history; reviewing over 500 SSME problems for process escapes and manufacturing problems; providing historic problem data related to the SSME HPFTP Channel B Speed Sensor issue as occurred on STS-111; and providing the 10-year history on SSME primary engine valve problems.

In implementation and operation of the MSFC Corrective Action System (CAS), we received 83 potential CAS reports (including 32 Customer Feedbacks), screened 84 draft Recurrence Control Action Requests (RCARs), and initiated 3 new RCARs. We received 4 responses from laboratory points of contact with either disposition rationale or response extension requests. We coordinated Corrective Action Board review of 2 RCARs, resulting in full closure of both of them. We also provided open RCAR status reports and discussed them at the Marshall Management System (MMS) Implementation Team meeting, issued monthly RCAR status and delinquent response reports, presented monthly metric charts of RCAR activities and statuses at the MMS Implementation Team, and prepared Corrective/Preventive Action System activities and status charts for presentation at the Marshall Quality Council.

4.2.3 ALERT Program

HEI's ALERT support included both regular and special activities as we coordinated MSFC ALERT processing. HEI received and distributed 21 ALERT announcements for MSFC review and obtained 529 responses from MSFC project, contractor, and laboratory contacts. Two of the released ALERTs were coordinated through Office of Inspector General (OIG) prior to release and one was a MSFC-initiated NASA advisory on SPS bolt material discrepancies. We participated in the annual GIDEP Workshop in San Diego by presenting a paper relating GIDEP and ISO at MSFC. At the request of Shuttle Assurance leadership, we briefed their personnel on ALERT processing, led two meetings to define process revisions for launch-imminent processing rules, and drafted changes to MWI 1280.5B, "MSFC ALERT Processing" to implement them. We also coordinated quick turn-around on 2 launch-imminent ALERT releases. Furthermore, we assisted software upgrades to the ALERT data system regarding conversion from http: to https: and implementing new users IDs associated with the TPS security system. We also converted our paper log of ALERT receipts and distributions since 1982 to Excel spreadsheets.

4.3 Quality

Space Transportation

External Tank (ET) Quality Engineering participated in an investigation into incorrect fasteners supplied to Lockheed Martin. During Lot Acceptance Testing of the high strength fasteners at

MAF, one of three fasteners failed material chemistry acceptance. The supplier, SPS Technologies, tested in-house fasteners from the same lot/batch and found mixed material. A Problem Advisory was generated and Lockheed Martin formed an investigation team to visit SPS Technologies. Investigation revealed the most likely cause of the mixed material lot to be inadequate material control of inventory at SPS Technologies. This issue was isolated to the lot detected during acceptance at Lockheed Martin and was not a constraint to flight.

Solid Rocket Booster (SRB) Quality Engineering participated on the Space Shuttle Solid Rocket Booster's Hydraulic Pump Port Cap Redesign Team. This redesign incorporated a lower torque value on the six port cap fasteners, along with the measurement of the running torque to determine the acceptability of the insert locking feature. Additionally, Quality Engineering participated in a process validation at Parker Abex to ensure that processes are documented, controlled and utilized. Quality Engineering is currently participating in an investigation on the Booster Separation Motor (BSM) FOD anomaly. On June 6, 2002 Chemical Systems Division operators noted a foreign particle imbedded in the BSM propellant. Investigation has determined the material to be Room Temperature Vulcanized (RTV). The investigation is continuing.

Space Shuttle Main Engine (SSME) Quality Engineering supported the Pre-Ship Review of Block II Engine 2055. The Low Pressure Fuel Turbopump (LPFTP) failed green run for a maximum shaft speed. During post test inspection the nozzle static seal was found incorrectly installed in the LPFTP S/N 2136. LPFTP 2136 was replaced with S/N 6007. Model predictions indicate acceptable performance. No technical issues were noted for the engine. Additionally, Quality Engineering supported a meeting at Kennedy Space Center with Rocketdyne and onsite MSFC S&MA engineers. The Space Shuttle flight engine process flow was reviewed and Government mandatory inspection points were presented and discussed.

Reusable Solid Rocket Motor (RSRM) Quality Engineering participated in the RSRM Engineering Test Motor #3 Design Technical Interchange Meeting (TIM). The TIM's focus was to review the ETM-3 design, loads, and environments, analytical methods, and associated Engineering Change Proposals. ETM-3 is the five segment Engineering Test Motor scheduled for static test in 2003. Additionally, Quality Engineering participated in a training class presented by the Defense Contract Management Agency titled, "The Control of Mandatory Inspection Documents (MID) and Surveillance Inspection Document (SID)".

Quality Engineering continued to support the Joint Group on Pollution Lead-Free Solder Project and the NASA Workmanship Technical Committee with the review and drafting of addendums to class 3 of J-STD-001C "Requirements for Soldered Electrical and Electronic Assemblies" to support NASA Requirements.

Second Generation/Reusable Launch Vehicle (2NDGEN/RLV) Quality Engineering assisted Systems Safety in developing Safety Requirements for the 2NDGEN/RLV Systems Requirement Document (SRD) and provided administrative support for both the 2NDGEN/RLV Technical Interchange Meeting (TIM) and the S&MA Coordination Team meetings. As a member of the both High and Low Pressure Turbomachinery Integrated Product Teams (IPT) for the COBRA & RS-83 Projects, QE provided requirements document review support including a review of the

COBRA Project Fracture Control Plan. Quality Engineering continues to track CDR Action Item Closeout activity and supports related Project milestone reviews.

Software Quality Assurance (SQA)

Software Quality Assurance (SQA) continued to support the Material Science Research Rack-1 (MSRR-1) and GLAST Burst Monitor (GBM). SQA attended the MSRR-1 Integrated Payload (IPL) Critical Design Review (CDR) and submitted a Review Item Discrepancy (RID) regarding the Space Product Development Experiment Module (SPDEM) Software Development Plan (SPD) and reviewed resulting documentation for the closure of an action item resulting from the RID. SQA activities for MSRR-1 also included a Software Configuration Management (SCM) audit. Actions noted included identification of documents and Computer Software Components (CSCs) maintained by project SCM or by ED14 OWI. SQA activities for GBM included participation in the Preliminary Design Review (PDR) conducted at the National Space Science and Technology Center (NSSTC). SQA also presented an overview of the Software Quality Assurance Plan (SQAP) prepared for the GBM Flight Software to be developed at NSSTC. SQA reviewed contractual documentation and submitted RIDs regarding software requirements traceability to system level requirements, coding standards, and Software Configuration Management activities.

ISO

Quality Engineering has continued to play a key role to ensuring the maintenance of ISO 9001 at MSFC during this time period. Efforts have dealt with continuing implementation of the ISO 9001: 2000 revision, maintenance of documentation, internal quality audits, and planning and support for the NQA registrar audit, including follow-up and closure of corrective actions. Quality Engineering provided general ISO support, including documentation reviews and consulting support on internal audits, training, continual improvement, and other aspects of ISO 9001, to various MSFC Organizations. Quality Engineering also performed an initial gap assessment of the MSFC management system against the AS 9100 Aerospace standard and began coordination with directives OPRs to finalize the assessment. The results of this assessment will be used in making a decision as to whether or not MSFC will pursue registration to AS 9100 in addition to the ISO 9001 registration.

Payloads

Quality Engineering (QE) supported the Window Observation Research Facility (WORF) project as a member of the Quality Assurance (QA) Panel in the WORF Functional Configuration Audit/Physical Configuration Audit (FCA/PCA). During this review QE reviewed test procedures. They included: WORF Video Qualification Test, WORF Command and Data Handling Qualification Test, WORF Thermal Qualification Test, WORF Power Qualification Test and the WORF Mechanical/Light Diffusion Test. There were a total of 3 (three) QA Panel action items submitted.

Quality Engineering (QE) supported the Glast Burst Monitor (GBM) project's Preliminary Design Review (PDR) at the National Space Science and Technology Center (NSSTC). The PDR was conducted to review the hardware and software developed from the Marshall Space Flight Center (MSFC), University of Alabama Huntsville (UAH) and the Max Planck Institute

(MPE) for the GLAST project. QE presented charts for S&MA. The charts included a brief overview of the S&MA Plan and the preliminary hazards that have been identified by the project.

Quality Engineering (QE) supported the Materials Science Research Rack/ Experiment Carrier project's Integrated Payload Critical Design Review (CDR) as Lead of the S&MA Review Team. The CDR demonstrated the interface compatibility between the MSRR-1/EC, the European Space Agency Materials Science Laboratory (ESA MSL) the Space Product Development (SPD) Experiment Module (EM), the International Space Station, the MSRR-1 operations center and the ground systems. The S&MA Review Team generated 11 Type 2 Review Item Discrepancies.

Quality Engineering (QE) supported the Gravity Probe B project's Incremental Acceptance Review at Stanford University at Palo Alto, CA. Following satisfactory resolution of issues raised during this review; the payload will be accepted for integrated flight-testing. QE also, participated in a Verification/Technical Summit at Stanford. This summit was held to discuss open verification and technical issues with Stanford, Lockheed and various MSFC disciplines on the GP-B Program. Quality Engineering (QE) supported a meeting at the Naval Research Laboratory (NRL) in Washington D.C. to discuss the Quality Assurance controls for the SOLAR-B Extreme Ultraviolet Imaging Spectrometer Instrument Components. The meeting also discussed the need for continuing the DCMA delegation to assure adequate compliance with project requirements.

Inspection and Test

HEI Quality Assurance continued to provide support in all MSFC test areas to MSFC test engineers and contract support personnel. The plasma arc facility, Test Stand (TS) 116, TS 300, TS 500, and the hot gas test facility are among the test areas supported by Quality Assurance. Test procedures and planning were reviewed to ensure that proper quality and test requirements are met on a day-to-day basis. HEI Quality Assurance continued to perform receiving inspections and witnessing of assembly and testing for DELTA-L, PCG, g-LIMIT, PCAM, MSG, VCD, ProSEDS, UPA, MSRR, QMI, SUBSA, PFMI, InSPACE, MGM III, PCAM, and OGS. Quality Assurance continued to support various projects at KSC during assembly, testing and integration of experiments in flight carriers.

4.4 Information Management (IM)

Information Management (IM) developed functionality to meet immediate needs during the quarter, including an application for use by QS30 in documenting stamp control; an application for use by QS personnel in voting for peer awards; functionality to allow QS Management Support Assistants the ability to track travel in a centralized location and produce a combined report; and an application for use by MSFC personnel in volunteering as a Safety mascot. IM also modified numerous applications. The Safety Concerns Reporting System (SCRS) was revised to incorporate screening questions, to provide a password-protected function for sending email messages to Building Managers, and to resolve inconsistencies in search results between databases. The ALERTs application was revised to allow the administrator to delete an organization. IM modified the Open Problem Tabulation and one-element reports in the Problem Reporting and Corrective Action (PRACA) system to calculate after 6 months from the Add

date. The Certification Tracking (Certrak) system was revised to allow search by expired certifications. IM modified the As-Built Configuration Status System (ABCSS) application to increase the size of the Drawing Rev of the Part Tag, modifying several forms to accept the new value. IM modified the Summary Update module and 11 database forms in the Customer Satisfaction application as requested by the Customer and Employee Relations (CaER) Directorate. In addition, It Could Happen To You (ICHTY) was revised to reduce required fields on input.

IM developed functionality that will result in significant process improvements. IM developed a database and forms for input of Safety facility inspection information on a Personal Digital Assistant (PDA). Inspectors reviewed the input forms and provided comments regarding necessary revisions. IM is also developing a program for editing the forms on a pc, then uploading the information to the Haztrak application. Automation of the input and edit functions will eliminate administrative input and improve data assurance and timeliness of data transmission. IM incorporated dynamic footers in S&MA web-based applications. Information for the footers is centralized in a database that was also deployed into production. Separate footers were created for incorporation into applications written in Active Server Pages (ASP) and Tango. The footers were revised to centralize functionality and improve speed for both the developer and the user. This innovation will significantly decrease development time necessary in maintaining accurate information that is required on web pages. Since the footers also contain links to the S&MA web-based application access request, Information Management Support Request and Customer Feedback forms, implementation of the footers will significantly improve S&MA information technology customers' communication capabilities. The ALERTs, SSWP and Certrak applications were revised to allow users to log in with their IDS password, which will improve the customer interface. The integrated access application also fulfills IT security requirements per NPG 2810.1, "Security of Information Technology", minimizing the necessity for redundant programming and administrative overhead activities and providing for streamlined processes. IM supported an Operational Readiness Review with representatives from MSFC's Information Services and Protective Services Departments. The functionality will be deployed upon approval by AD30.

IM incorporated Section 508 compliance requirements on several sites, including ISO 9000; Voluntary Protection Program (VPP); Contractor Safety Forum (CSF); SMA_01; the Safety, Health and Environmental (SHE) site; Dr. Know; the QS30 site; and the Problem Assessment Center (PAC) directory in the Tech site. Well over 1000 files were checked for compliance and problems were resolved. In addition, corrections were made in the ISO 9000 site to allow migration to an NT server. Section 508 ensures accessibility of web pages by visual- or hearing-impaired individuals. Section 508 retrofit activities for all applications and web sites managed by QS are included in S&MA's Section 508 Retrofit Plan to ensure that all S&MA web sites are compliant by the end of FY02. A process was also established to assure that 508 compliance is maintained when sites are revised.

IM coordinated the migration of the ISO 9000 and VPP web sites to a Microsoft NT web server, which will reduce cost since one less server will be maintained. IM revised one Information Technology security plan in order to provide the information on the latest template and obtained one required waiver. Due to the modification in the definition of a "site", IM requested web

registration and export control approval for 33 sites, which replace 2 requests that were previously submitted. In a parallel activity, numerous web pages or applications were either relocated or removed from the server and affected changes to links were coordinated.

4.5 Human Exploration and Development of Space (HEDS) Assurance

IA performed ISSP and SSP assessments and evaluations in several areas and investigated/evaluated launch issues associated with the STS-111 mission. IA also attended MSFC ISSP and SSP element meetings and participated in teleconferences with JSC IA personnel. IA attended a 5-day workshop that extensively covered tools of system safety.

4.5.1 International Space Station (ISS) Independent Assurance

ISSP evaluations/assessments performed during this period included: MSFC ISS Payloads Compliance with SSP 50431, MSFC compliance with SSP 30223, ISS Internal Thermal Control System (ITCS) Fluid Chemistry, and ISS Special Purpose Dexterous Manipulator (SPDM) Attach Pallet Hardware Acceptance Review.

4.5.2 Space Shuttle Independent Assurance

Space Shuttle element evaluations/assessments performed during this period included: Shuttle Contingency/Data Impoundment Plan Assessment, Shuttle requirements flow-down with respect to GFE, SRB compliance with SRB/SSP Requirements and Process Control, and SSME HPFTP Contamination.

4.6 Project Assurance

HEI Project Assurance (PA) personnel provided technical support and assessments of Space Shuttle flight readiness for Pre-launch Assessment S&MA reviews and the Center Director's Technical Issues Briefing for STS-111. HEI provided support at the Huntsville Operations Support Center (HOSC) during the launch of STS-110 during the reporting period. PA supported the S&MA consoles from "Level A" through main engine cutoff. The initial launch attempt for STS-110 on April 4, 2002 was scrubbed due to a weld leak in the ground support gaseous hydrogen vent line. On April 8, 2002 Shuttle Atlantis was successfully launched. Project Assurance also provided support at the HOSC for the launch of STS-111. Attempts to launch on May 30, 2002 and May 31, 2002 were scrubbed due to bad weather. Shuttle Endeavor was successfully launched on the third attempt on June 5, 2002. HEI personnel provided support for the ET, SRB, SSME and RSRM S&MA Assurance Offices. PA also provided Postflight assessment support at Hanger AF, Canaveral Air Station for STS-111.

Project Assurance continues to provide extensive support for the space shuttle pyrotechnics program. During the period, PA completed the review of United Space Alliance shelf life extension test report for the frangible nut booster cartridge Lot AAK. The test report, extending the shelf life of the lot from four to seven years in accordance with NASA requirements, was approved following incorporation of review comments. PA also completed initial review of the Aft Separation Bolt documentation package and represented MSFC S&MA at the Safe and Arm Device Explosive Lead Phase III review where the team conducted hardware inspection,

examined radiographic film and reviewed manufacturing, test and inspection documentation for an accepted quantity of 305 explosive leads.

SSME Project Assurance coordinated and attended the SSME reliability face-to-face meeting held at Stennis Space Center. Represented at the meeting were problem reporting experts from Rocketdyne, Pratt & Whitney, MSFC S&MA and Hernandez Engineering Inc., Problem Assessment Center (PAC) and the SSC MSFC Resident Office. The main subject of this working group was the problem reporting system. These annual meetings provide an opportunity for all to voice any concerns, build working relationships and improve overall communication and understanding of the entire problem reporting system.

Project Assurance also expended a great deal of effort in providing coordination support for the Aerospace Safety Advisory Panel visit to MSFC. The primary focus covered the Shuttle propulsion elements, Space Launch Initiative, Payload Operations Integration Center and the MSFC Safety and Mission Assurance organization. The meetings were very productive for the panel.

Transition/Privatization

Transition to the SFOC is complete. The next phase of the process is now known as "Competitive Sourcing". This new strategy is explained in the new budget proposals and involves providing greater flexibility, avoiding cost growth and moving NASA from an operator of infrastructure to and purchaser of services. This new course is not yet defined so PA has become involved in the working groups that will establish the basis for Competitive Sourcing. These groups include the Quality Leadership Forum, Process Control Focus Group, Joint Audit Planning Committee and the Supplier Assessment System. Involvement at these levels will allow S&MA to have influence and insight into the direction of the shuttle program in the future.

4.7 Risk Management and Risk Assessment

4.7.1 Risk Management

Project Assurance supported discussions with Futron Corporation to consider the relative merits of Enterprise Risk Management (ERM) implementation at MSFC. The first step would be to determine the current state of risk management implementation at MSFC and how well the current implementation is meeting the needs of the center, programs and projects. After the evaluation, Futron would provide recommendations describing implementation of ERM that would be consistent with MSFC organizational structure.

During the period, HEI taught one full course in risk management to Thiokol Corporation in Utah and provided a Continuous Risk management overview to the Gravity Probe B Project Manager and staff. HEI continues to review and upgrade the presentation material and tailor it specifically to the needs of MSFC programs and projects.

Project Assurance supported the Government Electronics And Information Technology Association G-48 System Safety committee meeting held at NASA headquarters in Washington DC. The G-48 System Safety committee brings together safety professional from both the Department of Defense and NASA. During the two days of meetings the committed heard

reports from the Navy, Marines, Air Force and NASA system safety representatives about the state of system safety requirements within the various organizations. Discussions centered on steps that can be taken to strengthen safety requirements to ensure adequate hazard identification and control during design and manufacture of hardware.

4.7.2 Risk Assessment

Risk Assessment (RA) participated in NASA's Contractor Safety Forum (CSF) intended to provide safety awareness to on-site contractors as well as general policy and procedures regarding safety in the workplace. RA also participated in a four-day Probabilistic Risk Assessment (PRA) workshop at JPL in Pasadena, CA in efforts to learn about the methodology of NASA PRA. Also at JPL, RA participated in another week-long offsite workshop along with Reliability and Maintainability (R&M), in an effort to explore the development of a coherent, sustained Agency plan for accelerating the attainment of higher reliability necessary for challenging current and future NASA missions. At this workshop, Risk Assessment, representing Marshall Space Flight Center, offered expertise in helping to answer questions relating to the Space Launch Initiative (SLI), specifically for the Second Generation Reusable Launch Vehicle (2GRLV) Program. Furthermore, RA helped in identifying current capabilities, limitations, and barriers to ultra-reliability and helped develop recommendations for getting started.

In direct support of the SLI 2GRLV program, RA participated in a weeklong offsite workshop intended to produce a coherent roadmap to the 2GRLV System Requirements Review (SRR) milestone, as well as to push an integrated effort between each of the SLI 2GRLV teams. Further support for the 2GRLV SRR program milestone included attending a three-day event at the Boeing Jetplex in Huntsville, AL in an effort to understand the present status of Boeing's architectures in the 2GRLV Program in lieu of the down-selection required for the SRR in November. RA also attended an engineering review of Lockheed Martin's planned approach for down selecting to a single TSTO vehicle segment also required for the SRR. RA also participated in the Northrop Grumman/Orbital Sciences Corporation (NG/OSC) Technical Interchange meeting (TIM) which was held as a follow-up to their Pre-Initial Architecture Review (pre-IAR). This TIM provided an interface between NG/OSC and NASA to discuss developments and pathways to their down-selection of a single architecture by the SRR.

Also during this period, RA supported the RMS Team by giving input at both group and team meetings on the development and status of offsite workshops at the 2GRLV contractor's facilities in California and Colorado, as well as current action items and other topics. RA participated in telecons conducted at the 2GRLV contractor's facilities in California and Colorado in support of the 2GRLV Team members who were physically present at the off-site contractors facilities. These telecons enveloped an attempt to further integrate and organize NASA-contractor 2GRLV RMS efforts. RA supported the RMS Team by giving input at both group and team meetings on ground rules and assumptions for analysis between contractors for the 2GRLV.

In other 2GRLV efforts, RA along with R&M, helped organize and conduct a meeting with relevant NASA representatives to discuss the modeling of advanced rocket engines, specifically the Co-Optimized Booster for Reusable Application (COBRA) and RS-83. Topics discussed

were recommended procedures and guidelines for developing these models, as well as the different tools needed in order to implement them

General 2GRLV support included attending a demonstration on the Baseline Comparison System (BCS), which is a database containing data on Shuttle, Space Shuttle Main Engine (SSME) etc. so as to establish a baseline comparison for 2GRLV architectures and components. RA also attended a two-day symposium held by the AIAA to provide a picture of the current state of the world's RLV's.

4.7.3 Space Shuttle Probabilistic Risk Assessment (PRA)

During this reporting period, Risk Assessment (RA) continued to work on the Space Shuttle PRA project. RA met with the shuttle PRA Technical Lead and four of the MSFC Prime Contractors (Lockheed Martin, Pratt and Whitney, Rocketdyne and United Space Alliance) to discuss current PRA modeling techniques and status.

In addition to regular status checks with each of the MSFC Prime Contractors, RA also supported the MSFC PRA Lead in discussing the current PRA status with the respective project offices. RA focused on the following areas during this reporting period. On ET PRA, RA assessed the effort needed in quantifying the fault tree models versus a simplified Event Sequence Diagrams, and provided support to Lockheed Martin in deciding which quantification method to use. On SSME PRA, RA continued to work with Rocketdyne and Pratt-Whitney on incorporating random and process failure models. RA has started reviewing the Rocketdyne PRA models and associated documentations. On RSRM PRA, RA worked with Thiokol on the incorporation of PFMEA and Hazard Report in to the PRA. On SRB PRA, RA worked closely with the SRB PRA Team Member on updating the PRA models with current flight data, and model re-quantification using QRAS software.

Finally, RA prepared and participated in the Shuttle PRA System Analysts Meeting (SAM) at HEI Corporate office in Houston and at JSC. Topics discussed at the SAM included current PRA modeling approaches used by the MSFC elements, PRA schedules, project and program office buy-in requirements, software issues and modeling status.

4.7.4 Reliability Prediction & Risk Assessment

RA is currently supporting two projects in ongoing flight issue investigations. A piece of silicone maintenance sealant was found in SRB booster separation motor (BSM) propellant during a manufacturing step. RA is representing S&MA in team meetings looking for cause, impact and corrective action on this problem. RA is specifically looking at risk assessment analyses and providing input to the program on their veracity. Missing data from a high-pressure turbopump is being investigated by an SSME team. RA is assisting in analysis of quality and problem history data in advance of the shuttle's return to KSC. RA is reviewing analyses and supplying synopses of the data to the S&MA management team.

RA assisted in the development of a positive flight rationale on an issue wherein during quality inspection a portion of a bolt production lot was found to have been made from an incorrect material. In part because of an excellent history from this manufacturer, it was determined that a

problem of this nature was unlikely to cause a problem, with either past lot receipts or in future lots. Changes to the lot acceptance procedure were suggested.

A project vendor's routine quality check of SRB range safety batteries showed an out-of-internal-specification condition on a production batch. Project S&MA came to RA to determine how many additional samples needed to be tested to assure goodness of the batch. RA took the position that the entire batch needed to be measured to ensure acceptable quality and backed this up with literature references. Because of the complexity of the testing, the vendor opted to discard the batch.

RA presented the results of its analysis of erosion in the RSRM nozzle to the RSRM project, transportation directorate, engineering directorate and ATK Thiokol RSRM staff. With representatives from MSFC Transportation Directorate 51 and ATK Thiokol, RA finished a first draft of a related paper during the Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee conference in August. RA's submission covers analyses relating RSRM nozzle erosion to various predictors. RA also continued support on postflight analyses of char and erosion trends in the nozzle and will be included in future meetings aimed at improving overall trending methods in the project.

RA presented results of an analysis of nose cone intermediate process quality data to the ET project. In it, RA recommended process improvements to increase consistency of finished product quality rather than widening specifications. RA additionally studied a wider range of intermediate and finished product quality measures and found several relationships between measures. It was found that while many of the commonly used quality measurements did not correlate with each other, several predictors do indicate results of measurements of downstream processes. At least one outlying anomalous quality measurement could be explained by indications of anomalies in precursor processes. These results will be presented to the ET project.

RA held a meeting to work with the SSME project in determining how to set up groundrules for use in building demonstrated reliability and PRA models of the main engine. The project has reviewed the failure history and delivered their assessment back to RA to build the models. Since the project came up with the assumptions themselves, a high level of buy-in to the models is expected.

RA is assisting in evaluating analyses by Pratt and Whitney aimed at establishing a particular life limit for turbine blades in the High Pressure Fuel Turbopump/ Alternate Turbopump (HPFTP/AT). Pratt has suggested treating the blade wheels as expendable parts, and has developed statistical justification for this approach. RA is assessing the assumptions and models in this case and is independently developing analysis tools.

RA updated the Statistical Evaluation of Launch History report with information through STS-110. The report shows overall delay history classified by cause, result, element and delay duration, with special focus on MSFC-caused delays. MSFC-caused delays are accounting for an increasingly lower proportion of delays of late. RA also revamped the appearance of this report. The report is now planned by S&MA management for general distribution among S&MA representatives to the projects.

Having responsibility for Center Directive MPG 8730.4 regarding use of statistics in center operations, RA made requested comments regarding potential revision of this document into SAE AS9100 Rev. A, Quality Systems – Aerospace – Model for Quality Assurance in Design, Development, Production, Installation and Servicing, Requirements In Addition To ISO 9001:2000. RA recommended a moderate amount of revision be done to bring the directive into conformance with the new standard. This should be done thoughtfully, as effects in MSFC operations could potentially be sizeable.

RA attended a five-day System Safety Fundamentals seminar covering topics such as risk assessment, preliminary hazard analysis, change analysis, fault hazard analysis and procedure review. RA also attended a brief overview of Six Sigma manufacturing practices. Finally, RA volunteered for the Marshall Safety Awareness Team at the annual Moon Buggy race attended by international college and high school teams.

5.0 COST REDUCTION ITEMS

Our continuing cross-utilization of employees, continuous analysis of work in progress to assure that application of resources meets the needs of the task, and the judicious acquisition and distribution of tools to enhance the efficiency of all team members allow us to minimize cost to the customer.